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学位論文の要旨（論文の内容の要旨）
Summary of the Dissertation (Summary of Dissertation Contents)

論　文　題　目
Dissertation title
Climate Change Resilience and Vulnerability of Farmers in Nepal

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Summary of Dissertation

Climate change refers to any change in climatic condition over the long period of time. Scientists are now more certain that climate change is due to anthropogenic activities. International and scientific community have general consensus that climate change will impact mostly the least developed countries which have limited capacity to adapt to it. Climate change will have adverse impact on socio-economy systems especially of those people whose livelihood directly depend on natural resources, such as those that depend on agriculture and forestry for their livelihood. As climate change will have impact on the society, it is very much necessary to understand the climate change from the social perspective. So this study analyses impact of climate change from vulnerability and resilience perspective.

The study focuses on the temporal and spatial dimension of climate change impact at national level and then focuses on analyzing climate change vulnerability and resilience at household level. Due to limitation in availability of meterological data, only temperature and rainfall are taken from 1978 to 2011 to represent changes in climatic factor. Trend analysis is used to analyze how temperature, rainfall and occurrence of natural hazard are changing over time. Seemingly unrelated regression is used to see the impact of climate change on occurrence of natural hazards. Also temperature and rainfall data are interpolated using ArcGIS for trend analysis. Further, trend analysis of

climate extremes using daily rainfall data from 202 to 2011 is used to see the variability in the climate. The result shows that there has been increasing temperature trend while rainfall is in decreasing trend and erratic in nature. The analysis shows that rainfall is increasing in the monsoon season especially in August increasing the probability of occurrence of natural disasters. The change in the climatic pattern has exacerbated the occurrence of natural hazards in the country which is also increasing rapidly. Also, climate extremes are in increasing trend over the period of 2002 to 2011 exacerbating occurrence of natural hazard. Landslide and flooding is found to be two most disastrous natural hazards in Nepal with flooding being most destructive of all. Hence seemingly unrelated regression analysis is used to analyse impact of climate change on occurrence of flooding. The result shows that increasing temperature will significantly increase the occurrence of heatwave. Similarly any increase in rainfall, especially in the monsoon season will significantly increase the occurrence of flooding while decrease in rainfall will increase occurrence of natural hazards like forest fire and drought.

As climate change impact is location specific, analysing impact of climate change from spatial perspective is important in Nepal where topography plays a major role. So, the study analyses and produces maps to show district wise climate change vulnerability in Nepal. The study uses interpolated temperature and rainfall data for mapping district wise change temperature, rainfall and natural hazard. Vulnerability is measured as function of exposure, sensitivity and adaptive capacity as stated by Intergovernmental Panel on Climate Change Fourth Assessment Report. Principal component analysis is used to give weights to the indicator since using expert judgment and giving equal weights has limitation of cognitive biases and being too subjective. The result shows that adaptive capacity plays an important role in determining the overall vulnerability of an area. The occurrence of natural hazards further exacerbates the exposure and will increase the vulnerability. The result is found to follow the pattern of district wise vulnerability according to NAPA by showing western part of the country comparatively more vulnerable than eastern part. But, the result is also able to show the difference in the vulnerability of district more properly. For example, Kathmandu district is found to be least vulnerable as it has high adaptive capacity while the result of NAPA shows it being most vulnerable.

Climate change is a global phenomenon but its impact will be felt at local level.

The least developed countries can do little about mitigation so have to adapt to the cl imate change. Hence the study analyses the households' adaptation practices and their perception to climate change. Further, the study also analyses impact of climate chang e from vulnerability and resilience perspective at household level. The analysis uses th e Heckman Selection Model for understanding the factors affecting households' percept ion and their adaptation. Also temperature and rainfall of household is analysed using the interpolated data. Resilience is analysed as the function of ability to absorb shoc ks and vulnerability. Further, determinant of resilience is analysed using multiple regre ssion analysis. The result shows that most of the households does not know the term climate change but has perceived some changes in climate. Households are more sensi tive to notice changes in the rainfall than change in temperature. They have been ada pting to these changes through reactive adaptation practices that they are practicing tra ditionally. Eighteen different adaptation practices are identified in the study area mainl y for conservation of soil and water. It is seen that majority of the farmers adopt pra ctices like agroforestry, conservation of water by building water tanks and rain water harvesting. The adaptation practices like prioritizing livestock is least favoured among households as there has been decrease in the availability of grass in forest. The result of Heckman Selection Model shows that there is correlation between perception of fa rmers and their adoption of adaptation practices. The result shows that information so urce has positive influence on households to perceive any changes in the climatic cha nge. Households' adoption of adaptation practices are significantly influenced by their possession of assets as well as the infrastructure present in the area.

The analysis shows that adaptive capacity and exposure is the major contributor fo r determining the households' vulnerability. Jhyaku has the highest vulnerability compa re to other two areas which is mainly attributed to lack of adaptive capacity as well as frequent occurrence of natural disasters. The factors like infrastructure contributed mainly to vulnerability. However, vulnerable households are also seen to be practicing more adaptation practices to cope with it. Thus the results points out that the househ olds are not just mere sufferer but also have capability to overcome the adverse impa cts. Further, the analysis shows that most of households belong to the group of low t o moderate resilience which can be mainly attributed to addition of new challenges fr om climate change. Also, the result shows that access to extension service center, pos session of livestock and higher number of crops planted played are significant factors

determining the resilience of the households.

Overall the study indicated temperature is rising and rainfall is erratic in Nepal which has increased the occurrence of natural hazards. So, mitigation of natural hazards like landslide and flood should be given prioritization. In addition to flood and landslide, there is need to give emphasis on the mitigation of the forest fire as it has been increasing steadily and also damaging the livelihood options in the rural areas. Also, there is need to improve climatic data management to capture micro-climatic variation of the area. This could help in reducing the casualties from natural hazards by providing early warning as well as in adaptation. Infrastructure being a significant factor for determining the vulnerability, its development should be given more prioritization. Developmental programs and policies should give more emphasis on the vulnerable area and households by capturing their capability to adaptation. Further, households should not just be seen as sufferer but also their capability to cope with changing condition should be understood. Additionally, climate change has added new challenges to households by reducing their resilience. So, climate change policy and developmental programs should focus on improving the households' resilience and decreasing their vulnerability.

This dissertation is divided into eight chapters. Chapter one, two and three deals with introduction and conceptualization where as other chapters deal with analytic analysis. Chapter four analyses the impact of climate change from temporal aspect by analysing climatic trend and its relationship with natural hazard at national level. Chapter five deals with spatial impact of climate change by analysing vulnerability at national level. Chapter six and seven analyses the adaptation practices, vulnerability and resilience at the household level. Finally the study is concluded in chapter eight with some recommendation.